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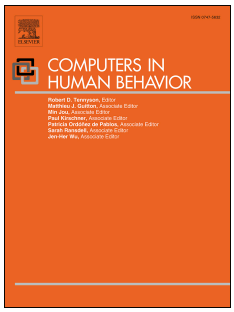

An education-based approach for enabling the sustainable development gear

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An education-based approach for enabling the sustainable development gear

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Abstract

The advances in Information and Communication Technologies (ICTs), together with social commerce initiatives, collaborative economy and education, are working together to move the gears of sustainable development. All of these aspects have the potential to revolutionize social business and contribute to future sustainable development. In the past few years, the economy has seen the emergence of modern business models and innovative ideas, mainly driven by ICT. Concepts such as social commerce, collaborative economy and virtual currencies establish new business models, in which participants seek equity exchanges, trust, cooperation, and a better redistribution of incomes. Education cannot be exempted from this evolution. Education should play an important role in society since it generates and transfers new knowledge and contributes to developing appropriate competencies on this matter. The objective of this paper is to analyse the role played by these components to promote sustainable development. The research method conducted in this work is twofold. First, a conceptualization of the key terms involved in this research was. Next, a constructivist approach centred on the student was conducted to enable the creation of learning proposals to prepare students to take advantage of the possibilities offered by the progress of technology to promote sustainable development and social commerce initiatives.

Keywords: learning innovation, social business, behavior intention, virtual currencies, sustainable development

An education-based approach for enabling the sustainable development gear

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1. Introduction

Currently, society is more sensitive to sustainability agendas and therefore demands new and more sustainable models in the development of the economy and global markets, driven by a reconsideration of the entire consumption cycle (Luchs et al., 2011). Consumers demand more information about the sustainability of available products, and its social and environmental attributes. In response, governments and companies are reassessing the traditional consumption scheme (acquire, use and then dispose of the used goods) to promote the reuse of products instead of just buying new products. This extends the useful life of existing products and avoids the need for additional resources to make new products.

The new social economy encourages and facilitates this type of social trade by eliminating preconceived barriers of traditional trade and by improving the economic performance of under-utilized assets, especially in the users' hands. They look for the citizens to be active participants in business processes, promoting their production with minimal environmental impacts and social costs. Its implementation can reduce the environmental footprint and improve the sustainability of economic processes (Phipps et al., 2013).

These social economy initiatives provide a great potential for the achievement of the Sustainable Development Goals of the United Nations (SDG, 2015) to transform our world, especially in the education field (Quiroz-Niño and Murga-Menoyo, 2017). The Toy Library Federation of New Zealand provides a good example through the exchange of toys, as it not only satisfies the needs of others, but is also as a space for children to learn positive values of sharing, responsibility for use, and respect for other users (Ozanne and Ballantine, 2010).

In this way, innovations are generally produced by society. Social innovations are new solutions, such as products, services, processes, business models or markets, that meet a social need more effectively than existing solutions (Caulier-Grice et al., 2012). Frequently, social innovation comes from technology change, such as crowdfunding through internet platforms or secure transactions through virtual currencies. Therefore, technology plays an important role in social innovations, either by providing alternative solutions to old technologies or by providing the socio-technical platform whereby social innovation takes place, allowing large scale cooperation and the emergence of new business models. In this vein, the expansion of social economy schemes to many sectors of trade and the economy has been facilitated by the growth of digital platforms and its technological development (Yaraglhi and Ravi, 2017). The high degree of penetration of mobile devices and the growth of their interaction and processing capabilities facilitate the creation of business models among consumers (Cohen et al., 2016). Additionally, the development of communication technologies has made Internet-based services available to more people around the world, improving the efficiency of business processes and contributing to the development of the social economy. In this way, e-commerce applications are generally designed for mobile devices with Internet access, which allows them to conform to the user's availability and provides flexibility for commerce (Smith, 2016).

Disruptive technologies are potentially causing profound changes in organizations and society, and they are the bases for creating new opportunities and developing innovative business models (Karimi & Walter, 2016). The digital world is gaining considerable importance in all social and economic activities (Rao-Nicholson et al., 2017). In this context, education is a fundamental component for the success of Sustainable Development (SD) initiatives since they must appropriately combine innovative practices and models, knowledge and new technologies. Higher levels of education create a bridge between these factors and the society (Rieckmann, 2012; Visvizi et al., 2018). In addition, the ability to influence graduates to instil a sense of leadership will also support a strategy for promoting sustainability in our future world (Przychodzen et al., 2016). In turn, SD education promotes

transdisciplinary approaches, individual engagement and development of synergistic group actions that help reduce entrepreneurship complexity and uncertainty (Leal Filho *et al*., 2018).

A revealing summary of previous SD studies in the field of education can be seen in Table 1. Although learning innovation and social business has received considerable attention in the literature, there is gap between how these connects with SD. Many high schools have begun their commitments to SD, however, the recent technological advances that are changing the world require an understanding of the role of new disruptive technologies to update new ideas and social trends, and a review of educational curricula. This is the context that frames this work. In accordance with the foregoing issue, this article addresses the following research questions:

Q1. What are the key components for promoting SD in education using disruptive technologies?

Q2. How do these components relate to each other to promote SD?

Q3. What digital skills and abilities can be identified from these relationships to promote sustainable business ventures?

The purposes of this research are the following. First, it aims identify and analyse the key components to promote SD and new disruptive ICTs to support them such as virtual currencies. Second, to identify connections among key components and how they can work together to create sustainable approaches. Third, the results allow us to identify knowledge and new digital skills to be included in the educational curriculum and teaching-learning initiatives to engage the students in promoting SD.

The remainder of this paper is organized as follows. Section 2 describes a general overview of the main components of the sustainable development mechanism and the research methodology of this work. Section 3 describes the background of sustainable development in the dimensions developed in this work. Section 4 describes the education commitment and the academic availability of the main topics discussed. Next, the new digital skills are proposed. At the end of the section, an example of learning innovation initiatives is described. Lastly, we provide concluding remarks in Section 5.

2. The concept of sustainable development

Sustainable development is a transdisciplinary concept that integrates social, economic and environmental dimensions to cover the diverse needs of today's world (Pawłowski, 2008; Sinakou et al., 2018). It has several components with implications on many areas of the society.

Sustainability requires a paradigm shift in education, which should be characterized by reflective and interactive learning in participatory environments (Egelund *et al.*, 2016). Inclusion of the sustainability concept in education generates a multiplier effect as it identifies priorities in business ventures (Kankovskaya *et al.*, 2016). In order to facilitate sustainable practices, it is necessary to understand and learn new ICTs that link different transdisciplinary approaches. Moreover, in order to achieve greater efficiency and accessibility to didactic resources, it is necessary to apply the collaborative economy principle in education: "knowledge as a shared resource" (Bandyopadhyay et al., 2016). In this work, some of these components related to social business and learning content are discussed together. The way they work together gives rise to the idea of a sustainable development gear. Figure 1 shows how all these concepts are closely connected.

Table 1. Representative summary of previous SD studies in the field of education

Research	Findings
Sustainability through educational models (Hoveskog *et al.*, 2018)	Students' understanding is increased through innovative ventures.
Barriers that arise in sustainable initiatives in higher education institutions (Alexio *et al*., 2018).	The lack of funds is the main barrier to implementing SD initiatives. The commitment of the participants is the main driver of sustainability. Higher education institutions recognize the importance of sustainable development although they are not clearly familiar with its concept.
Sustainability and accountability of educational management (Annan-Diab & Molinari, 2017)	Interdisciplinarity aligned with education for SD, promotes understanding of complex problems and provides possible actions to address them.
Standards of education in terms of SD (Kankovskaya *et al.*, 2016)	The formulation of principles and objectives for the Russian education and innovation system.
Sustainability goals and commitment of academic staff (Cebrián *et al.*, 2015).	Academic staff have different interpretations and knowledge of sustainability and its interdisciplinary nature.
Key competences of SD in higher education institutions (Rieckmann, 2012).	Interdisciplinary work leads to SD social, economic, technological and ecological changes.
Holistic approach to the SD concept (Sinakou *et al.*, 2018)	Academics do not conceive of the holistic concept of SD.

Fig 1. Sustainable development gear

The main definitions of these components are as follows:

(i) *Education as the key to sustainable development.* This is the main component for raising awareness of SD among the population. A sustainable future is achieved through education and in the socio-collaborative interactions of learning activities (Abdul, Mohd, & Udin, 2013). Education provides the knowledge and skills for students to start create sustainability initiatives. Through sustainability, the management of educational projects is more efficient, lucrative and economical. In this way, the holistic vision of sustainability attracts and establishes links between the student, higher education institutions and society (Alexio *et al*, 2018). These links represent the collaborative approach to education for sustainable development. Through collaborative relationships, education promotes the learning of multiple disciplines to address sustainability challenges (Ofei-Manu & Didham, 2018). Education involves all actors in the learning process and integrates sustainability competencies within each disciplinary context (Egelund *et al.*, 2016). In addition, education promotes critical thinking to balance the economic and social needs of a sustainable project (Chin & Jacobsson, 2016). In this sense, education provides entrepreneurship and identifies sustainability as a competitive advantage for the new business generation (Karlusch, *et al.*, 2018).

(ii) *The collaborative economy as the path to sustainability*. The collaborative economy promotes initiatives to optimize the use of material resources and skills (Heinrichs, 2013).Purchase intent is motivated by variety of complex factors such as trust, loyalty, price, etc. (Busalim, Razak, & Hussin, 2016). Recently, SD plays an important role in this behaviour since consumers also seek to tread more lightly on the earth by reducing their overall consumption of material goods (Luchs et al., 2011). The term 'collaborative economy' originates in the social interactions enabled by ICTs (Laurell & Sandström, 2017). ICTs facilitate the interactions of users so that they share skills and knowledge amongst themselves (Martin, 2016) and contribute to the generation of collaborative business models (Annan-Diab & Molinari, 2017). ICTs are necessary as they support sustainable practices and behaviors among participants (Alexio *et al.*, 2018). The collaborative economy promotes the decentralized exchange of goods and services through P2P platforms (Acquier, Daudigeos, & Pinkse, 2017). Collaborative platforms for economy-sharing enable consumers to reduce their environmental footprint as the need to purchase new goods is reduced, and they serve as an incentive for saving economic resources (Phipps et al, 2013). In this way, collaborative consumption can be considered a manifestation of sustainable behaviour and a way to contribute to sustainable living (Luchs et al., 2011). The collaborative economy empowers citizens and decentralizes power structures in the economy and in society (Martin, 2016). According to this ideology, virtual currencies are disruptive technologies that perfectly fit and promote the collaborative and sustainable economy.

(iii) *Sustainable development through social commerce*. Social commerce is a field of communication that combines advertising, marketing and sales, which are closely linked to the economy (Oleynikova & Zorkin, 2016). In addition, social commerce combines knowledge from other disciplines, such as computer science, sociology and psychology (Huang & Benyoucef, 2013), which enriches and broadens its definition. This concept enables individuals to relate in a collaborative and participative manner (Baghdadi, 2016). The development of social commerce optimizes the transfer and exchange of knowledge through the cooperation of its participants and, therefore, it is transmitted through the opinions, comments and responses generated on social networks (Jiang, Ma, Shang, & Chau, 2014). Social commerce promotes a continuous social learning complemented by users' real experiences. These experiences enhance learning the values of sharing, responsible use, and environmental respect. In turn, social commerce platforms become a tool for measuring acceptance and control of the learning process (Al-Rahmi *et al.*, 2018). Social commerce websites can be used as virtual classrooms to improve students' skills. In this sense, social interactions can generate a collaborative and supportive environment for learning activities (Abdul *et al.*, 2013). Thus, social commerce becomes a social learning resource that allows students to share and validate their knowledge through peer support (Al-Rahmi *et al.*, 2018).

These concepts are further developed in the next sections. The methodology used in this study has various phases. The first phase is a Qualitative Descriptive (QD) component to provide definitions of the key terms and to introduce a conceptual framework in which the main components are connected. Next, is a review of the educational offering and an analysis of the key components. The last phase is based on the Problem-Based Learning approach and proposes a set of skills and knowledge for the topics of interest.

3. Sustainable Development Background

3.1. Definitions

There are different definitions in the literature of the terms used in this work. To dispel any ambiguity and better focus on the topics of study, it is important to clearly define the key terms involved in this research based on recent references and new approaches.

- *Social organization*: A social organization or enterprise can be defined as "an organization that exists for a social purpose and participates in commerce to fulfil its mission, using market-based techniques to achieve social goals" (Luke and Chu, 2013). Therefore, it operates similarly to

traditional companies with the objective of achieving a social profit.

- *Social Business*: Social businesses are designed to use market mechanisms to solve social challenges. In this way, its aim is not to maximize profits. Instead, the success of social business depends on the impact of the business on people, environment and/or whole society. This business model considers all stakeholders and not only shareholders (Yunus et al., 2010). Social business combines business and societal characteristics and it is created and designed to address a social problem (Avidar, 2017).
- *Social Commerce*: This concept is considered as an e-commerce evolution (Huang & Benyoucef, 2013). This term can be defined as the exchange-related activities that occur in, or are influenced by, social networks, where the activities correspond to need recognition, pre-purchase, purchase, and post-purchase (Yadav et al., 2013). Generally, the use of Internet-based media enables users to participate in the selling, buying, comparing, and sharing of information about products and services in marketplace and communities (Zhou, Zhang, & Zimmermann, 2013).
- *Sharing Economy*: The sharing economy, or collaborative economy, or collaborative consumption is the activity of obtaining, giving, or sharing access to good and services, coordinated through community-based online services (Hamari et al., 2015; Yaraglhi & Ravi, 2017). This phenomenon is mainly characterized by a high level of trust within the communities instead of centralized institutions. The emphasis is placed on business models based on horizontal networks and with a high degree of community participation, where the boundaries between the producer and consumer are weak (Botsman & Rogers, 2011).
- *Social Economy*: There is no clear, precise and unanimously accepted definition for the social economy. In this work, this term is considered when there is confluence between the business field and the social field. The social economy's primary aim is the stakeholders' welfare and socio-economic inclusion (Matei & Dorobantu, 2015). As such, social economy is the economy generated by social business and social organizations, where the utility of these companies is based on their social purpose and on the democratic, participative values that they bring to the operation of the company (CIRIEC, 2017).
- *Sustainable Development*: SD concept has become too comprehensive and complex, since it is involved in many areas (Holden et al., 2014). Therefore, this concept must translate into practical measures to show its contribution to social progress. Based on the original definition of (UN,1987) and previous research by (Alexio *et al.*, 2018; Anand *et al.*, 2015; Annan-Diab & Molinari, 2017; Wiek *et al.*, 2011; Kankovskaya, 2016), this research defines sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs, through transdisciplinary practices and the development of key competences in education promoted by new ICTs to create collaborative business models."

3.2. Social commerce and collaborative economy development

Social commerce emerges as a new paradigm in the evolution of e-commerce (Busalim et al., 2016), which highlights the technological advances made in constructing a new socially oriented business model (Baghdadi, 2016). It is not only about technology but it's about people and about changing human behaviours thanks to new computer advances and other disciplines such as marketing, sociology or psychology (Strauss et al., 2016). The social commerce model, can achieve social objectives through innovative designs with the help of technology that is very difficult to implement for traditional companies.

On the other hand, the new concept of the 'Sharing Economy' provides a business model oriented towards satisfying the needs of consumers who also take advantage of new technologies and the Internet. This model encompasses new business practices that share some degree of participation or collective organization in the provision of goods and services (Botsman & Rogers, 2011). In this case, the proposition is essentially based on access to the unproductive good as opposed to its acquisition, and excludes the demands and expenses involved in the appropriation of goods. In fact, the suppliers of goods and services - when sharing their assets - do not surrender ownership of them (Furchtgot-Roth, 2016).

It is estimated that currently there are approximately 7,500 collaborative platforms globally, with transportation, housing, and the labour markets being the most active sectors (Yaraglhi & Ravi, 2017). This variety in offerings has caused an attitude change towards consumption by a sector of society, especially the youngest. It is estimated that around half of this population prefers to share before buying, and a third of them say they use shared services regularly. These data indicate a clear future trend in the development of this type of commerce (de Rivera et al., 2017).

Most of the current legislation includes the new social economy reality that, in some cases, is linked to the concepts of 'social entrepreneur', 'social enterprise', and 'social innovation'. These elements form a social objective and participate in commerce to fulfil their mission, using market-based techniques to achieve social goals (Yunus et al., 2010).

A fundamental element of the role of technology is the dramatic reduction in the transaction costs of a business relationship. In this way, interesting tangible benefits of the sharing economy can be identified, such as the saving of time and money, as well as other intangible benefits such as the creation of a network of users that increases the business possibilities, the commercial offering, or the reduction of the costs of information searches (Acquier et al., 2017). This collaborative business model contributes decisively to SD and to building solid communities (Botsman & Rogers, 2011).

Online social support creates specialized and self-sustainable networks, which provide access to resources and stimulate mutual collaboration among its members (Chewning and Montemurro, 2016). Other positive externalities occur with the construction of communities and the development of collaborative social media (Roh, 2016). In this regard, the sharing economy and social commerce can also be considered as a type of social economy since there is social economic activity behind it.

As a result, the following consequences of the beneficial development of the collaborative economy are identified (Martin, 2016; Karabell, 2017): (i) the collaborative economy is a path of implementation of social commerce, and an equitable, sustainable and decentralized economy. One of its conceptual pillars is to take advantage of the excess capacity in a society's assets to generate marginal income; (ii) the collaborative economy is a more sustainable form of

consumption since it can reduce the need for capital intensive investments to create new manufactured goods by sharing them locally. (iii) The collaborative economy provides innovative economic opportunities and it demonstrates the power of the society in providing consumer and business solutions by taking advantage of the opportunities offered by technology.

Once some characteristics of collaborative companies and the social economy are recognized, it can be noted that the presence of economic variables in the collaborative economy clearly occurs through continuous production activity, existence of economic risk and paid work. Meanwhile, the search for an explicit social objective and the dimension of participatory government are two elements of friction between both spaces. Thus, in the social economy, the concrete activity that is carried out does not really matter, but rather how it is developed in practice. On the other hand, the collaborative economy focuses more on the shared use of existing resources rather than on resource ownership, and also on the capabilities of new technologies for expediting the exchange of these resources. Nevertheless, undesirable situations may occur that must be corrected with new legislation or modernization of existing legislation. These situations may be conflicts in the maintenance of the privacy and security of user data, or in the maintenance of adequate guarantees for parties to the commercial transaction (Stemler, 2016).

3.3. ICT support for Sustainable Development

The current growth of the phenomena of social commerce and collaborative economy is mainly due to the possibilities provided by technological development to improve creativity, and collective and shared productivity. This subsection describes the main aspects of computing architectures and the role played by technology in new payment methods.

The new ICT capabilities and the modern social media interactions have led to a notable shift in focus away from businesses and towards the consumer (Choy and Park, 2016). In this way, the consumer-centric approach aims to produce services that are in need.

In general terms, Computer Supported Cooperative Work (CSCW) is the system that allows multiple users to interact through computerized systems to perform tasks collaboratively. A fundamental premise in CSCW is that technology could help them do this more efficiently. Currently, CSCW systems support social commerce initiatives that are evolving towards mobile platforms that are context-aware, proactive and ubiquitous. On the other hand, the term ‘"Uberization’ is a new buzz-word derived from the business model of the Uber Company. In this case, the computer system that supports it offers a real-time service, grouping resources together and allocating small percentages of service costs (David et al., 2016).The CSCW and the Uber-type systems (US) are different because the latter are essentially oriented to short-term transactions and limited to establishing a platform-mediated relationship between supplier and consumer. We must bear in mind that the US has mandatory service requirements for the intermediation platform that manages the relationship between the provider and the consumer, who are compatible in profile and objectives.The intermediation platform has at its disposal a large amount of information either in real time or previously compiled. Using selection techniques and appropriate algorithms, it can propose one or more potential responses to the client (consumer), which allows it to refine their problem and to find appropriate solutions (David et al., 2016).

The architecture of modern collaborative systems is generally organized in three layers (David et al., 2016):

- Distributed System Model: layer of network services and system.
- Infrastructure Model: generic collaborative services layer.
- Collaborative Applications Model: Human-Computer-Interaction (HCI) layer and specific application.

These architectures work in practice as systems of intermediation that connect people, services and even things. A simple ‘peer-to-peer’ approach allows an agile matching of service users. However, in most cases, a central element is required to efficiently coordinate and provide security to business processes.

The computer architectures that support these systems are based on the paradigm of a Service Oriented Architecture (SOA). Figure 2 illustrates a general design of this architecture. In addition, the new shape of a ‘shared global economy’ requires cloud services to be collaboratively provisioned by different cloud providers in a geo-distributed manner. This design provides them with the key potential for flexibility and scalability needed for success (Haddad, 2015; Aulkemeier et al. 2016).

In the previous infrastructure design, collection and analysis of the generated transaction data are used to improve processes and generate business intelligence for improving service and customer satisfaction (David et al., 2016; Lytras et al., 2017)

3.4. Decentralized payment systems and virtual currencies

The philosophy behind the collaborative economy promotes free markets of intermediation based on decentralized access and the reduction of transaction costs of products and services (Acquier et al., 2017). Likewise, the current trend is that these systems do not accept cash, but only accept electronic means of payment.

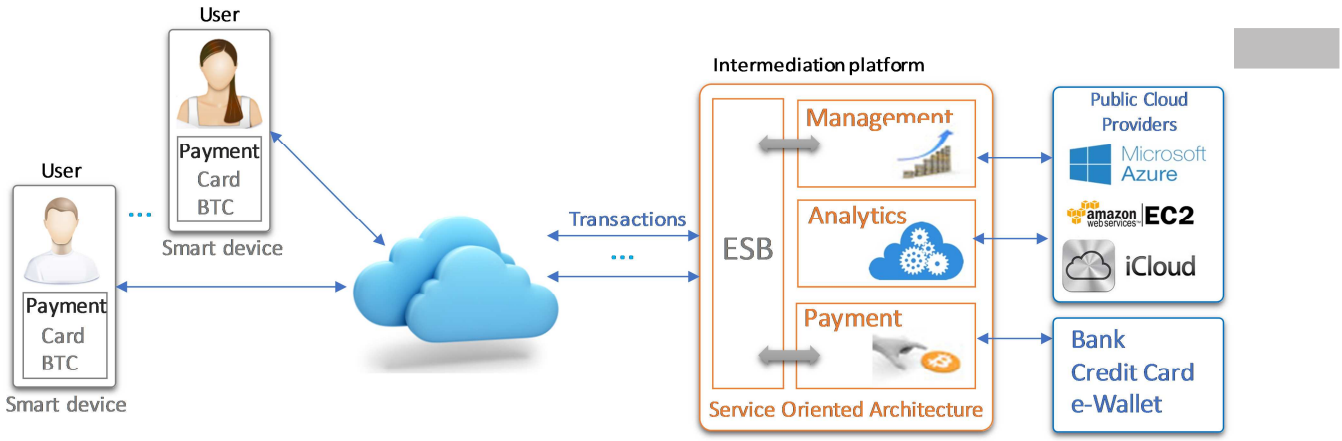

Fig 2. General overview of a collaborative business architecture

New ICT technologies have been developed to advance these objectives. In recent times, disruptive changes have indeed taken place. A technology can be disruptive or it can represent an incremental change only. An innovation that changes the performance metrics or consumer expectations of a market by providing radically new functionality is disruptive (Nagy et al., 2016).

Blockchain technology and its support for the creation of virtual currencies is one of the disruptive technologies that make this change possible since they eliminate intermediaries and therefore transaction costs (Pazaitis et al., 2017, Mearian, 2018). Blockchain facilitates communication for the participants in the process of a transaction. In this way, blockchain eliminates the hierarchical structures of a society to promote collaboration and equal opportunities in society. One of the most successful blockchain implementations and a testimony to its radical transformation of the way to make electronic payments is the *Bitcoin* cryptocurrency

There can be no doubt about the added-value of virtual currencies in social commerce. In the first place, virtual currencies such as Bitcoin provide trust between parties unknown to each other without the need for a third party (Giaglis & Kypriotaki, 2014). Its supporting technology ensures transparency, integrity and accurate identification in recording transactions. In addition, this means of payment gives financial and payment freedom to social commerce transactions. In this way, the lack of a third-party intermediary eliminates the high international rates for monetary transactions (Egorova and Torzhevskiy, 2016).

As virtual currencies grow in popularity, this will be just another payment method that can be used for transacting in social commerce and sharing economy. More concretely, the contributions of virtual currencies to producing the positive consequences mentioned in the previous section are the following:

(i) In relation to their contribution to the sharing economy, virtual currencies (through P2P platforms) can be used by citizens to directly share: goods, services and information. Collaborative system interactions are essential requirements for a business initiative to be part of a sharing economy (Muñoz & Cohen, 2017). In this way, virtual currencies are technologies that promote the same philosophy of a sharing economy – the development of markets free from intermediation, based on decentralized access, and a reduction in access costs for products and services (Acquier, Daudigeos, & Pinkse, 2017).

(ii) In relation to its contribution to sustainable consumption, the absence of a physical representation (paper or metal) contributes to a significant saving in the costs of production, transport and handling of currency (Ciaian and Rajcaniova, 2016). Furthermore, the divisibility characteristics and the number of significant digits used, allow the execution of micropayments and the realization of small value transactions that would not be profitable in traditional payment systems.

(iii) In relation to the implementation of social commerce, virtual currencies clearly contribute to decentralizing socio-economic structures through their financial exchange platform.

The underlying infrastructure of the virtual currencies is independent of their geographical location and crosses international borders. The technological requirements for the use of cryptocurrencies are relatively minimal, so currently, any user with a mobile device or a computer connected to the internet can send cryptocurrencies anywhere in the world. In this way, they provide a social economy service through the construction of alternatives for transferring money with minimum cost for international remittance services and without the intermediation costs of control authorities and customs.

Likewise, virtual currencies provide financial tools to citizens who lack the economic capacity to participate in the traditional banking system. A user who uses cryptocurrencies is not obliged to justify their financial capacity with personal background information, since the protocol does not discriminate users under any conditions. In a payment system based on cryptocurrencies, the financial capacity is not approved or supervised by any central bank risk. In this way, the use of cryptocurrencies can reduce the gap in social inequality and provide equal opportunities for society to obtain benefits. In this same vein, they offer alternative methods of payment to citizens from countries of economic instability or with a weak currency subject to high inflation.

The versatility and functionality implemented in social commerce platforms is improved. In this way, virtual currencies can act as a disruptive technology to enhance social commerce initiatives. For example, social media can use cryptocurrencies as an incentive to generate content (Jing, 2017). The generation of content in social media is a social commerce strategy that arises when the user publishes and shares content through social functions such as: recommendations, references, ratings, reviews, forums and communities. Social media obtain information about the satisfaction, preferences and advertising of a product (or service). Social media has a prominent presence when it manages to interact with the largest number of followers to learn about their habits. Similarly, a social commerce platform can use cryptocurrencies as a strategy to gain greater

recognition and positioning on the web. Then, users are rewarded with virtual currency fractions for posting content, sharing a link or following a specific social network.

The monetization of digital content through micropayments (with cryptocurrencies) promotes social commerce activities and improves producer-consumer content relationships without the need for external payment mechanisms subject to commissions. The consumer will only pay for their preferred content and can enjoy it without unwanted advertising, while contributing to the consumption of digital content that is shared on the web. In the same way, the content producer (author) will increase their profits, optimize the use of their content and have a greater diversity of clients. Thus, content creativity can be increased using virtual currencies in social purchases. An author will make his or her best effort to publish high-quality content, since gratification will depend on the number of downloads and the ranking obtained from consumers. An author owns his or her own content regardless of the advertising model used. A free intermediation payment method encourages the author to create content of value for a consumer, instead of paying for advertising on online search engines. As a result, it is evident that cryptocurrencies and their blockchain technology provide valuable tools for the design of decentralized social networks and promote social commerce. In addition, social commerce and virtual currencies are mutually reinforcing since social commerce works as a driver to enhance trust and intention to use virtual currencies in electronic payments (Mendoza-Tello et al., 2018).

(iv) Finally, virtual currencies themselves generate innovative business opportunities and create new ways of working. Numerous initiatives are emerging in line with the possibilities that this technology provides (BitPesa, 2016; Attia, 2017).

However, given that the technology used for virtual currencies is still in an experimental phase, many questions arise regarding the perceived risk (Tandon et al., 2018), security and privacy of using cryptocurrencies, the vulnerability of the software these currencies use, or the actual acceptance of the cryptocurrencies by users, among other factors.

4. Education

4.1. Higher education commitment to sustainable development

Education is a source of sustainability awareness creation (Fadeeva & Mochizuki, 2010). The goals of the university directly affect the dynamics of technology and social systems in these aims. Sustainability has to be understood as a learning process where education adds value with innovative contributions to all economic, social, environmental and cultural aspects (Rieckmann, 2012). In this way, higher education can catalyse and/or accelerate a societal transition toward sustainability since it is a key driver for sustainable development (Alexio et al., 2018).

Over the years, society has become increasingly aware and committed to the challenges of sustainable development. Higher education has promoted initiatives and statements around it (Grindsted and Holm, 2012). Among these initiatives are the *Talloires Declaration* (ULSF, 1990) signed by over 500 university leaders in over 50 countries, *The Kyoto Declaration on Sustainable Development* (IAU, 1993) that convened 650 universities around the world, the UNESCO - *World Declaration on Higher Education for the Twenty-First Century* (UNESCO, 1998) that affirmed the core mission of universities in contributing to sustainable development and improving society as a whole. Other initiatives include The Declaration of Barcelona (EESD, 2004), *The Declaration on the Responsibility of Higher Education for Democratic Culture - Citizenship, Human Rights and Sustainability* (Council of Europe, 2006), and the Nagoya Declaration on Higher Education for Sustainable Development (UN, 2014) with more than 750 participants from 66 countries.

One element of consensus in the conclusions of many of them is that research and technological development is of vital importance for a sustainable future. That is the reason why higher education must play a leading role in this transformation (Lambrechts and James, 2016). This can be defined as education that prepare students to achieve an active role in society with the purpose of promoting a process of transition towards a sustainable society. In addition, scientific experiences are reformulated, and new forms of knowledge emerge for decision making (Tejedor et al., 2018). Some competences have been defined for SD, based on the idea that the complexity of current and future problems of society cannot be corrected using classical education models. Every key model of competence for the SD are defined in a general level and applicable to all students of higher education study programs. Educational models should emphasize in systemic thinking, foresight thinking, and the ability to negotiate with uncertainty. These competences can help, through active participation in society, to modify and shape the future of it and to guide its social, economic, technological and ecological changes along the lines of sustainable development (Rieckmann, 2012).

Most universities have already introduced elements of SD promotion into their educational programs as a key part of their educational curricula (OECD, 2007) and to promote the efficient use of resources or the development of the new economy, for example. One of the most relevant competencies to be cultivated is entrepreneurship (Lambrechts and James, 2016). While many European frameworks are encouraging the introduction of entrepreneurship in higher education curricula, critical situations remain around the type of entrepreneurship in which it is focused. When it is interpreted within an economic model oriented towards the search for efficiency models, this can be contradictory with sustainability competencies.

4.2. Academic availability,

There are studies about the knowledge and skills needed to manage the new disruptive businesses associated with the following dimensions: innovation, leadership and management (Sousa & Rocha, 2018). However, the number of areas of knowledge that must be combined to solve problems is growing. Therefore, education must evolve to be more project-based and focus on work to solve problems with no known solutions versus a focus on individual projects with known solutions (European Schoolnet, 2016). The skills identified need a considerable development oriented by the target objective. After a detailed study, it is confirmed that the key disruptive technologies related to Social Commerce and Sustainable Development described above are beginning to be introduced in the educational plans of universities and business schools.

To know the current state of the educational offering in this area, this section reviews the contents of the most

recognized online education platforms used in the last year (Shah, 2018). Coursera (https://www.coursera.org/) with 30 MM registered users and EdX (https://www.edx.org/) with 14 MM users. These platforms provide an educational offering of over 2,000 courses, each supported by an alliance of several world-renowned universities and professors. The educational offering of these online platforms is more flexible than the curricula of traditional universities as they adapt the offer to the training demand of society, and do not require a bureaucratic process to modify their degrees. However, the trends of the offering are continually and rapidly changing (Zhu et al., 2018). Currently, education seems to demand more focus on outcomes and technologies that truly matter (Calhoun Williams, 2017). Considering this trend, there is no standardized classification of online courses in the different platforms.

Figure 3 categorizes the courses in relation to the main concepts studied in this work. Other topics are included to compare the learning offering with more common and well-known courses. From the data obtained, there are some findings related to the educational offering available in the main online training platforms:

- It is observed that there is a large number of courses in traditional disciplines such as *economy* and *business*. However, the offer is very limited in *social business* courses.
- In relation to commerce, there is a wide range of both general *commerce* and *electronic commerce*-oriented courses, which indicates the high degree of maturity of this commercial channel. Nevertheless, there are no courses exclusively focused on *social commerce*.
- *Sustainability* and *Sustainable Development* offer a wide range, but *collaborative economy* still does not have enough training courses.
- Finally, the technologies on new ways of payment based on virtual currencies timidly appear among the available offer, which contrasts with the number of courses on electronic commerce and Internet.

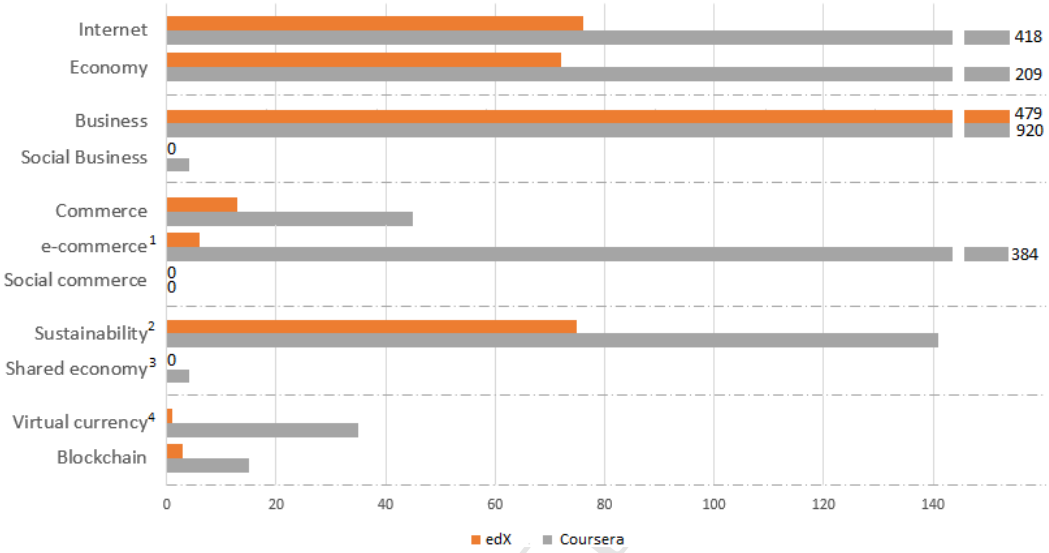

Figure 3. Course offering in the two main online training platforms - edX and Coursera. Retrieved on 05-02-2018.
[1] e-commerce | electronic commerce | commerce online
[2] sustainability | sustainable development | sustainable commerce
[3] shared economy | collaborative economy
[4] virtual currency | cryptocurrency | Bitcoin

4.3. Knowledge and New Digital Skills

One of the methodologies used to discern the necessary contents to promote SD is the Problem Based Learning (PBL) method (Egelund *et al.*, 2016). PBL is a constructivist approach centred on the student. This methodology has been used to create learning scenarios which motivates the students to build knowledge and skills through cooperation and interaction with others. In this way, PBL promotes critical thinking and allows the student to learn while solving a significant problem (Bransford et al, 2002; Mohd *et al.*, 2012).

The designed framework has four main aspects to be defined: knowledge, learner, community, and assessment. Firstly, *knowledge* refers to the knowledge and skills that the student acquires at the end of the course. In this regard, Table 2 describes the key areas of knowledge and their contribution to the development of competencies among students. The areas of knowledge were selected because of their implicit relationship with each other. It should be noted that the sharing economy and collaborative platforms allow the sharing of goods, skills and knowledge in social commerce functionalities (Martin, 2016). Both promote the equitable and sustainable distribution of resources. In the same way, the sharing economy and social commerce converge in the experience of social and collaborative purchases. It is important to note that one of the most successful implementations in P2P platforms is cryptocurrencies. Based on this evidence, Table 3 proposes a set of skills for each area of knowledge; Secondly, *learner* refers to the ideas and prior knowledge that students have to help each other; Thirdly, *community* refers to the collaborative learning environment through which students will learn and access the teaching resources. In this issue, the teacher staff have played an important role by providing right materials and bibliography, and fourthly, *assessment* refers to the comments

that the student receives according to their initiatives and progress. In this study, the relevant work theme to develop this methodology is "the role of virtual currencies to promote SD through social commerce initiatives and shared economy", and Appendix A is an example of proposed learning scenario. This work describes an educational innovation activity in line with the proposed objectives and the contents described in the previous tables. This activity is being developed into a Master in Computer Engineering at the University of Alicante during the second semester of 2018.

Through the application of the PBL method, students learn content through experience and new thinking strategies. In addition, students improve their self-learning and communication skills to solve real-life problems (Phungsuk *et al*, 2017). Finally, through the knowledge and new digital skills described in tables 2 and 3, this course aims to be a tool to promote learning and engage students on sustainable development and to make known the potentialities of new disruptive technologies

Table 2. Areas of knowledge

Skill	Skill development contribution
I. Sharing economy	Provides an overview and analyses the different perspectives of the sharing economy. Apply the necessary principles to create diverse business models based on sharing economy. Create, innovate and diversify the business area to exploit new sustainable business opportunities through the sharing economy.
II. Virtual currencies	Analyse and relate the means of payment based on virtual currencies to the philosophy of the sharing economy to promote the development of free markets for intermediation based on decentralized access.
III. Social commerce	Design social commerce strategies to interact with the consumer and influence the purchase intention. It uses social support skills to produce relationships of trust and comfort with the consumer. Implement social media in collaborative and sustainable business models.

Table 3. Knowledge and new digital skills

Knowledge	New digital skills
I. Sharing Economy	
• Fundamentals of the sharing economy (Acquier et al, 2017; Muñoz & Cohen, 2017; Gruszka, 2017) – Access Economy – Platform Economy – Community- based economy • The sharing economy as an economic opportunity (Martin, 2016; Muñoz & Cohen, 2017) – Micro-enterprise ventures – New business opportunities – Creation of new ways of working • The sharing economy as a more sustainable form of consumption (Martin, 2016; Heinrichs, 2013) – Consumption based on access – Decentralized and equitable economy – Efficiency in the use of resources – Analysis of the evolution of the sharing economy under different political, social and environmental conditions – Transdisciplinary research in specific areas of the sharing economy • Criticisms of the sharing economy (Martin, 2016), – Creation of unregulated markets – Paradigm of neoliberal economy – Inconsistencies in the field of innovation	• Analyse the academic literature and understand the main aspects surrounding the sharing economy • Analyse the sharing economy from the perspective of disruptive business innovation. • Understand the nature of collaborative businesses, their dimensions and their risks. • Identify the potential of the sharing economy to increase micro-enterprises and labour market flexibility. • Know the computer architectures to implement sharing economy solutions. • Analyse patterns of consumer behaviour through digital technologies. • Investigate the versatility of the sharing economy to transform production and consumption systems. • Prepare economic models based on P2P access and promoted by social freedom and equality. • Develop business models of the sharing economy and analyse the impact. • Provide initiatives to share skills and resources not used through decentralized digital platforms. • Investigate and promote collaborative economy models as a solution for sustainable development.
II. Virtual Currencies	
• Conceptualization of virtual currencies (Antonopoulos, 2015; Lim et al., 2014; Nakamoto, 2008). – Security mechanisms in transactions – Requirements for use – Implications of widespread use in society – Benefits and risk of use • Integration of virtual currencies in the collaborative and sustainable economy. – Decentralization of social and economic structures – New forms of sustainable consumption – Financial inclusion to persons without banks – Learning new financial applications	• Identify decentralized virtual currencies and learn the necessary requirements for their implementation in electronic commerce. • Use virtual currencies to make monetary transactions. • Identify the inherent benefits and risks of using virtual currencies. • Analyse the incidences of virtual currencies in the daily activities of the user, the economy, legislation, technological dependence and future research. • Recognize the contribution of virtual currencies within the collaborative and sustainable economy.
III. Social Commerce	
• Fundamentals of social commerce and social media (Baghdadi, 2016; Busalim, Razak, & Hussin, 2016; Laurell & Sandström, 2017). – Definition of social commerce	• Understand the concept and activities of social commerce. • Identify features of web 2.0 and 3.0 to create business models which are attractive to the client. • Use the constructs of social commerce (forums, reviews,

- Principles of social commerce design
- Applications of social commerce
- Social commerce development process
- The role of social support

- Integration of social media in the sharing economy
  - Impact of social media on consumers
  - User behaviour
  - Adoption strategies
  - Social and digital innovation

recommendations) as social tools to interact with others.

- Design strategies focused on social media that support commercial activities.
- Use social media as a collaborative environment to share experiences and promote content and information.
- Develop online communities to establish social support, trust and satisfaction among the members of a community that share resources and promote sustainable development.

5. Discussion and Conclusions

As we can see from this research, the social economy is rapidly progressing both in human and economic domains. It is a model in which human capital is considered more important that financial capital and it works towards reducing inequalities. It has been shown that technology like Blockchain could become a key element in the expansion of social economy models.

This research makes contributions both to the theory and practice: First, this research proposes a framework comprised of four key components that are fostering the SD change in economic and social domains: social commerce, sharing economy, new ICTs, and education. Although this study does not include all the activities of the teaching-learning process, it provides a theoretical background that allows higher education institutions to joining the sustainable agenda through specific knowledge and new digital skills. This transdisciplinary improves student practices and instils a greater awareness of sustainability. As a result, this work connects social commerce and collaborative economy with education for promoting sustainable development. This relationship promotes educational initiatives that emphasize collaborative consumption of its participants.

Another issue emphasized by this work is the importance of integrating virtual currencies into social commerce. Through them, social commerce becomes an incentive platform related to creativity and content monetization. In addition, this study reveals how the inclusion of social commerce in the collaborative economy can generate new ventures and social businesses.

Regarding to the contributions to the practice. We have been able to highlight that, despite the large number of courses specializing in social economy, there still isn't high interest in introducing specific courses on new disruptive technologies, such as virtual currencies. However, we consider that in the near future, based on the fact that their introduction and acceptability will be much more widespread, most educational curricula will add the study of these new technologies. In fact, it is foreseeable that the study of cryptocurrencies will be integrated into the study programs of many universities together with subjects related to social commerce and sustainability, such as those we have examined in this research study. For these reasons, this study proposes a set of knowledge and digital skills to prepare students for leveraging the possibilities offered by the progress of the technology. It provides educational institutions with the guidelines to integrate multiple disciplines that in turn promote sustainable business initiatives in their students. In addition, a learning innovation initiative has been proposed related to these concepts. We believe that this proposal will enable students to pursue the orderly and sequential incorporation of knowledge in their mental schema to obtain skills and abilities from a significant learning, which will improve their professional development.

As a future study, a questionnaire is being prepared for the students of the master's degree in Computer Engineering at the University of Alicante. Its purpose is to survey the state of their opinions and knowledge in the area of social economy and in the use of virtual currencies. Hereafter, we will make a quantitative and qualitative analysis of the answers received to make conclusions relating to the questions we have covered in this first investigation. In addition, there is a gap in the empirical evidence on how new digital skills are being assimilated by students. Future studies should treat the issue of technology assimilation. Finally, future work could be oriented towards corporate demand for specific professional skills in new technologies to complement the proposals presented here. In this way, the key features of innovative and successful business models can guide the research.

References

Abdul, A., Mohd, K., & Udin, A. (2013). Development of Students' Knowledge-Behavioural Changes in Relation to Sustainability through a Case Study. Procedia - Social and Behavioral Sciences, 102, 568–576. doi: 10.1016/j.sbspro.2013.10.773

Acquier, A., Daudigeos, T., & Pinkse, J. (2017). Promises and paradoxes of the sharing economy: An organizing framework. *Technological Forecasting & Social Change*, *125*(July), 1–10. doi: 10.1016/j.techfore.2017.07.006

Alexio, A. M., Leal, S., & Miranda, U. (2018). Conceptualization of sustainable higher education institutions, roles, barriers, and challenges for sustainability: An exploratory study in Portugal. *Journal of Cleaner Production*, 172, Pg. 1664-1673. doi: 10.1016/j.jclepro.2016.11.010

Al-Rahmi, W. M., Alias, N., Othman, M. S., Marin, V. I., & Tur, G. (2018). A model of factors affecting learning performance through the use of social media in Malaysian higher education. Computers and Education, 121, 59–72. doi:10.1016/j.compedu.2018.02.01

Annan-Diab, F., & Molinari, C. (2017). Interdisciplinarity: Practical approach to advancing education for sustainability and for the Sustainable Development Goals. International Journal of Management Education, 15(2), 73–83. doi:10.1016/j.ijme.2017.03.006

Attia B. (2017). How Blockchains Will Help Connect Billions to Electricity and Financial Services, *IEEE Spentrum*. Available online at https://spectrum.ieee.org/energywise/energy/renewables/how-blockchains-will-help-connect-billions-to-electricity-and-financial-services, Accessed on 31-01-2018.

Aulkemeier F. et al. (2016). A Service-Oriented E-Commerce Reference Architecture, *Journal of Theoretical and Applied Electronic Commerce Research*, 11(1): 26-45. doi: 10.4067/S0718-18762016000100003

Avidar, R. (2017). Public relations and social businesses: The importance of enhancing engagement. Public Relations Review, 43: 955-962. doi: 10.1016/j.pubrev.2017.03.015

Baghdadi, Y. (2016). A framework for social commerce design. *Information Systems*, 60, 95–113. doi: 10.1016/j.is.2016.03.007

Bandyopadhyay, S., Bardhan, A., Dey, P., Das, S., Ghosh, S., & Biswas, P. (2016). "Education for all" in a connected world: A social technology-driven framework for e-mobilizing dormant knowledge capital through sharism and mass collaboration. Humanitarian Technology: Science, Systems and Global Impact. Procedia Engineering, 159(June), 284–291. doi:10.1016/j.proeng.2016.08.180

BitPesa Blog. (2016). How Premise makes payments to Africa in minutes. Available online at https://www.bitpesa.co/blog/how-premise-makes-payments-to-africa-in-minutes/, Accessed on 31-01-2018.

Botsman, R., & Rogers, R. (2011). *What's mine is yours: how collaborative consumption is changing the way we live.* Ed. HarperCollins Business. ISBN-10: 0007395914

Bransford, J., Vye, N., & Bateman, H. (2002). Creating High-Quality Learning Environments: Guidelines from Research on How People Learn. The Knowledge Economy and Postsecondary Education: Report of a Workshop. Washington, DC: National Academies Press. doi: 10.17226/10239

Busalim, A. H., Razak, A., & Hussin, C. (2016). Understanding social commerce: A systematic literature review and directions for further research. *International Journal of Information Management*, 36(6), 1075–1088. doi: 10.1016/j.ijinfomgt.2016.06.005

Caulier-Grice, J., Davies, A., Patrick, R., & Norman, W. (2012). Defining Social Innovation, The theoretical, empirical and policy foundations for building social innovation in Europe project. European Commission – 7th Framework Programme, DG Research. Available online at https://youngfoundation.org/wp-content/uploads/2012/12/TEPSIE.D1.1.Report.DefiningSocialInnovation.Part-1-defining-social-innovation.pdf, accessed on 29-06-2018.

Cebrián, G., Grace, M., & Humphris, D. (2015). Academic staff engagement in education for sustainable development. Journal of Cleaner Production, 106, 79–86. doi: 10.1016/j.jclepro.2014.12.010

Chewning, L. V and Montemurro, B. (2016). The structure of support: Mapping network evolution in an online support group. Computers in Human Behavior, 64, 355–365. doi: 10.1016/j.chb.2016.07.006

Chin, A., & Jacobsson, T. (2016). TheGoals.org: Mobile global education on the Sustainable Development Goals. Journal of Cleaner Production, 123, 227–229. doi:10.1016/j.jclepro.2015.08.061

Choy M., Park G., (2016). Sustaining Innovative Success: A Case Study on Consumer-Centric Innovation in the ICT Industry, *Sustainability*, 8(10): 986. doi:10.3390/su8100986

Ciaian, P., and Rajcaniova, M. (2016). The digital agenda of virtual currencies: Can BitCoin become a global currency?, *Information Systems and E-Business Management*, 14, 883–919. doi: 10.1007/s10257-016-0304-0

CIRIEC-International, (2017). Recent Evolutions of the Social Economy in the European Union, European Economic and Social Committee, available online: http://www.ciriec.ulg.ac.be/wp-content/uploads/2017/10/RecentEvolutionsSEinEU_Study2017.pdf, accessed on 27-04-2018.

Cohen, P., Hahn, R., Hall, J., Levitt, S., and Metcalfe, R. (2016). *Using Big Data to Estimate Consumer Surplus: The Case of Uber. Massachusetts: National Bureau of Economic Research*. doi: 10.3386/w22627

Council of Europe, (2006), Global Network for Higher Education and Democratic Culture, Declaration on the Responsibility of Higher Education for a Democratic Culture - Citizenship, Human Rights and Sustainability. Available online at: https://www.coe.int/t/dg4/highereducation/democraticculture/Declaration_EN.pdf, Accessed on 31-01-2018.

David, B., Chalon, R., & Yin, C. (2016). Collaborative Systems & Shared Economy (Uberization): Principles & Case Study. IEEE *International Conference on Collaboration Technologies and Systems (CTS)*, pp. 57-63. doi:10.1109/CTS.2016.27

de Rivera J. et al. (2017). A netnographic study of P2P collaborative consumption platforms' user interface and design, *Environmental Innovation and Societal Transitions*, 23: 11-27. doi: 10.1016/j.eist.2016.09.003

EESD - Engineering Education for Sustainable Development (2004), Declaration of Barcelona. Available online at: http://www.iau-hesd.net/sites/default/files/documents/declaration_of_barcelona_english.pdf, Accessed on 31-01-2018.

Egelund, J., Hadgraft, R., Kolmos, A., & Guerra, A. (2016). Strategies for education for sustainable development - Danish and Australian perspectives. Journal of Cleaner Production, 112, 3479–3491. doi: 10.1016/j.jclepro.2015.09.063

Egorova, N. E., and Torzhevskiy, K. A. (2016). Bitcoin: Main Trends and Perspectives. *British Journal of Economics, Management & Trade*, 12(1), 1–11. doi: 10.9734/BJEMT/2016/19763

Fadeeva, Z., & Mochizuki, Y. (2010). Higher education for today and tomorrow: university appraisal for diversity, innovation and change towards sustainable development. *Sustainability Science*, 5(2): 249-256. doi: 10.1007/s11625-010-0106-0

Furchtgot-Roth, H. (2016). *The Myth Of 'Sharing' In A Sharing Economy*. Forbes, Available online at:: https://www.forbes.com/sites/haroldfurchtgottroth/2016/06/09/the-myth-of-the-sharing-economy/#2c7812659bfd, Accessed on 31-01-2018.

Giaglis, G., and Kypriotaki, K. N. (2014). Towards an Agenda for Information Systems Research on Digital Currencies and Bitcoin. *Business Information Systems Workshops*. *Lecture Notes in Business Information Processing*, 183: 3–13. doi: 10.1007/978-3-319-11460-6_1

Grindsted TS., Holm T. (2012). Thematic development of declarations on Sustainability in Higher Education, *Environmental Economics*, 3 (1): 32-40. doi: 10.2139/ssrn.2697500

Haddad E. (2015). Service-Oriented Architecture: Scaling the Uber Engineering Codebase As We Grow, Uber Engineering, Available online at: https://eng.uber.com/soa/, Accessed on 04-02-2018.

Hamari, J., Sjöklint, M., and Ukkonen, A. (2015). The sharing economy: Why people participate in collaborative consumption. *Journal of the Association for Information Science and Technology*. 67 (9): 2047-2059. doi:10.1002/asi.23552

Heinrichs, H. (2013). Sharing Economy : A Potential New Pathway to Sustainability. *Gaia 22*, *4*, 228–231.

Hoveskog, M., Halila, F., Mattsson, M., Upward, A., & Karlsson, N. (2018). Education for Sustainable Development: Business modelling for flourishing. Journal of Cleaner Production, 172, 4383–4396. doi:10.1016/j.jclepro.2017.04.112

Holden E. et al., (2014). Sustainable development: Our Common Future revisited, *Global Environmental Change*, 26: 130-139. doi: 10.1016/j.gloenvcha.2014.04.006

IAU - International Association of Universities, (1993) The Kyoto Declaration on Sustainable Development. Available online at https://iau-aiu.net/IMG/pdf/sustainable_development_policy_statement.pdf, Accessed on 31-01-2018.

Jiang, G., Ma, F., Shang, J., & Chau, P. Y. K. (2014). Evolution of knowledge sharing behavior in social commerce: An agent-based computational approach. Information Sciences, 278, 250–266. doi: 10.1016/j.ins.2014.03.051

Jing, M. (2017). A new 'bitcoin' for social media but will YouTube, Facebook and Instagram users buy?, Available online: http://www.scmp.com/tech/start-ups/article/2115621/new-bitcoin-social-media-will-youtube-facebook-and-instagram-users, accessed on 27-04-2018.

Kankovskaya, A. R. (2016). Higher Education for Sustainable Development: Challenges in Russia. Procedia CIRP, 48, 449–453. doi:10.1016/j.procir.2016.03.153

Karabell S. (2017). The Sharing Economy: Innovation Vs. Regulation, Forbes. Available online: https://www.forbes.com/sites/shelliekarabell/2017/04/06/the-

sharing-economy-innovation-vs-regulation/#fd69cc2e5940, Accessed on 01-02-2018.

Karlusch, A., Sachsenhofer, W., & Reinsberger, K. (2018). Educating for the development of sustainable business models: Designing and delivering a course to foster creativity. Journal of Cleaner Production, 179, 169–179. doi: 10.1016/j.jclepro.2017.12.199

Lambrechts, W., & James, H. (2016). *Research and Innovation in Education for Sustainable Development.* (W. L. Hindson, Ed.) Viena, Austria. doi:ISBN : 978-3-902959-08-9

Leal Filho, W., Raath, S., Lazzarini, B., Vargas, V. R., de Souza, L., Anholon, R., … Orlovic, V. L. (2018). The role of transformation in learning and education for sustainability. Journal of Cleaner Production, 199, 286–295. doi: 10.1016/j.jclepro.2018.07.017

Lytras, M. D., Raghavan, V., & Damiani, E. (2017). Big data and data analytics research: From metaphors to value space for collective wisdom in human decision making and smart machines. *International Journal on Semantic Web and Information Systems*, 13(1), 1-10. doi: 10.4018/IJSWIS.2017010101

Luchs, M., Naylor, R., R.L., R., Catlin, J., Gau, R., and Kapitan, S. (2011). Toward a sustainable marketplace: Expanding options and benefits for consumers. *Journal of Research for Consumers*(19), 1-12.

Luke, B., and Chu, V. (2013). Social enterprise versus social entrepreneurship: An examination of the 'why' and 'how' in pursuing social change, *International Small Business Journal*, 31(7): 764-784. doi: 10.1177/0266242612462598

Martin, C. J. (2016). The sharing economy : A pathway to sustainability or a nightmarish form of neoliberal capitalism ? *Ecological Economics*, *121*, 149–159. doi: 10.1016/j.ecolecon.2015.11.027

Matei, A., & Dorobantu, A. (2015). Social economy – added value for local development and social cohesion. *Procedia Economics and Finance*. 26: 490-494. doi: 10.1016/S2212-5671(15)00878-3

Mearian L. (2018). What is blockchain? The most disruptive tech in decades, Computerworld, Available online at: https://www.computerworld.com/article/3191077/security/what-is-blockchain-the-most-disruptive-tech-in-decades.html, Accessed on 05-02-2017.

Mendoza-Tello, J.C., Mora, H., Pujol-López, F.A., Miltiadis, L., Social commerce as a driver to enhance trust and intention to use cryptocurrencies for electronic payments, *IEEE Access*, 2018. doi: 10.1109/ACCESS.2018.2869359

Mohd, K., Ahmad, S., Syed, H., & Aliah, F. (2012). Creating a Constructively Aligned Learning Environment using Cooperative Problem Based Learning (CPBL) for a Typical Course. Procedia - Social and Behavioral Sciences, 56, 747–757. doi: 10.1016/j.sbspro.2012.09.712

Muñoz, P., & Cohen, B. (2017). Mapping out the sharing economy: A configurational approach to sharing business modeling. *Technological Forecasting & Social Change*, *125*, 21–37. doi: 10.1016/j.techfore.2017.03.035

Nakamoto S., (2008). Bitcoin: A Peer-to-Peer Electronic Cash System, pp. 1-9. Available online at: https://bitcoin.org/bitcoin.pdf, Accessed on 05-06-2018.

Nagy, D., Schuessler, J., and Dubinsky, A. (2016). Defining and identifying disruptive innovations. *Industrial Marketing Management*, *57*, 119–126. doi: 10.1016/j.indmarman.2015.11.017

OECD - Organisation for Economic Co-operation and Development. (2007). *Higher Education for Sustainable Development.* Final Report of International Action Research Project. Available online: https://www.oecd.org/education/innovation-education/centreforeffectivelearningenvironmentscele/45575516.pdf, Accessed on 31-01-2018.

Ofei-Manu, P., & Didham, R. J. (2018). Identifying the factors for sustainability learning performance. *Journal of Cleaner Production*, *198*, 1173–1184. doi:10.1016/j.jclepro.2018.06.126

Oleynikova, E., & Zorkin, Y. (2016). Social commerce as a driver of sustainable development of the information economy of the city. Procedia Engineering, 165, 1556–1562. doi: 10.1016/j.proeng.2016.11.893

Ozanne LK., Ballantine PW., (2010). Sharing as a form of anti-consumption? An examination of toy library users, *Journal of Consumer Behaviour*, 9: 485–498. doi: 10.1002/cb.334

Pawłowski A., (2008). How many dimensions does sustainable development have?, Sustainable Development, 16: 81–90. doi: 10.1002/sd.339

Pazaitis A. et al. (2017). Blockchain and value systems in the sharing economy: The illustrative case of Backfeed, Technological Forecasting and Social Change, 125: 105-115. doi: 10.1016/j.techfore.2017.05.025

Phipps, M., Ozanne, L., Luchs, M., Subrahmanyan, S., Kapitan, S., & Catlin, J. (2013). Understanding the inherent complexity of sustainable consumption: A social cognitive framework. *Journal of Business Research*, 66(8): 1227-1234. doi: 10.1016/j.jbusres.2012.08.016

Phungsuk, R., Viriyavejakul, C., & Ratanaolarn, T. (2017). Development of a problem-based learning model via a virtual learning environment. Kasetsart Journal of Social Sciences, 38(3), 297–306. doi: 10.1016/j.kjss.2017.01.001

Przychodzen, J., Gómez-Bezares, F., Przychodzen, W., & Larreina, M. (2016). ESG Issues among fund managers—Factors and motives. *Sustainability*, 8(10), 1078. doi: 10.3390/su8101078

Quiroz-Niño C., Murga-Menoyo MA., (2017). Social and Solidarity Economy, Sustainable Development Goals, and Community Development: The Mission of Adult Education & Training, *Sustainability*, 9, 2164. doi: 10.3390/su9122164

Rao-Nicholson, R., Vorley, T., & Khan, Z. (2017). Social innovation in emerging economies: A national systems of innovation based approach. Technological Forecasting & Social Change, 121: 228-237. doi:10.1016/j.techfore.2017.03.013

Rieckmann, M. (2012). Future-oriented higher education: Which key competencies should be fostered through university teaching and learning? *Futures*, *Vol. 44*(No. 2), Pg. 127-135. doi: 10.1016/j.futures.2011.09.005

Roh T.H., (2016). The sharing economy: Business cases of social enterprises using collaborative networks, Procedia Computer Science 91: 502 – 511. doi: 10.1016/j.procs.2016.07.129

Shah D. (2018). By the Numbers: MOOCS in 2017, Class Central. Available online at: https://www.class-central.com/report/mooc-stats-2017/, Accessed on 05-02-2018.

Sinakou, E., Pauw, J. B., Goossens, M., & Petegem, P. Van. (2018). Academics in the field of Education for Sustainable Development: Their conceptions of sustainable development. Journal of Cleaner Production, 184, 321–332. doi: 10.1016/j.jclepro.2018.02.279

Smith, A. (2016). *Shared, Collaborative and On Demand: The New Digital Economy.* Pew Research Center, Available online at: http://www.pewinternet.org/2016/05/19/the-new-digital-economy/, Accessed on 05-02-2018.

Stemler, A. (2016). The Myth of the Sharing Economy and Its Implications for Regulating Innovation. *Emory Law Journal*, 16-62. doi: 10.2139/ssrn.2828308

Strauss, J., Turban, E., and Lai, L. (2016). Social Commerce Marketing, Technology and Management. Cham: Springer. doi: 10.1007/978-3-319-17028-2

Sustainable Development Goals, (2015), United Nations. Available online: http://www.un.org/sustainabledevelopment/sustainable-development-goals/, accessed on 30-01-2018.

Tandon, U., Kiran, R., & Sah, A. N. (2018). The influence of website functionality, drivers and perceived risk on customer satisfaction in online shopping: an emerging economy case. *Information Systems and E-Business Management*, 16(1), 57–91. doi: 10.1007/s10257-017-0341-3

Tejedor, G., Segalàs, J., & Rosas-Casals, M. (2018). Transdisciplinarity in higher education for sustainability: How discourses are approached in engineering education. Journal of Cleaner Production, 175, 29–37. doi:10.1016/j.jclepro.2017.11.085

ULSF - Association of University Leaders for a Sustainable Future (1990), The Talloires Declaration. Available online at http://ulsf.org/wp-content/uploads/2015/06/TD.pdf, Accessed on 31-01-2018.

UN - United Nations (1987), Report of the World Commission on Environment and Development: Our Common Future, World Commission on Environment and Development A/42/427, available online: http://www.un-documents.net/our-common-future.pdf, accessed on 30-04-2018.

UN - United Nations (2014), Nagoya Declaration on Higher Education for Sustainable Development, Available online: https://i.unu.edu/media/ias.unu.edu-en/news/5466/HE_Declaration_FINAL_EN.pdf, Accessed on 31-01-2018.

UNESCO, (1998), World Declaration on Higher Education for the Twenty-First Century: Vision and Action Available online at http://www.unesco.org/education/educprog/wche/declaration_eng.htm, Accessed on 31-01-2018.

Visvizi, A., Lytras, M., & Daniela, L. (2018). (Re) Defining Smart Education: Towards Dynamic Education and Information Systems for Innovation Networks. In A. Lytras, M., Daniela, L., Visvizi (Ed.), Enhancing Knowledge Discovery and Innovation in the Digital Era. IGI Global. ISBN13: 9781522541912.

Wiek, A., Withycombe, L., & Redman, C. L. (2011). Key competencies in sustainability: A reference framework for academic program development. Sustainability Science, 6(2), 203–218. doi:10.1007/s11625-011-0132-6

Yadav, M., De Valck, K., Hennig-Thurau, T., Hoffman, D., & Spann, M. (2013). Social Commerce: A Contingency Framework for Assessing Marketing Potential. *Journal of Interactive Marketing*, 27: 311-323. doi: 10.1016/j.intmar.2013.09.001

Yaraglhi, N., & Ravi, S. (2017). *The Current an Future State of the Sharign Economy* (Brookings India IMPACT Series No. 032017 ed.). New Delhi: Brookings Institution India Center.

Yunus M. (2010), Muhammad Yunus: Social Business, Forbes, available online: https://www.forbes.com/2010/06/15/forbes-india-muhammad-yunus-social-business-opinions-ideas-10-yunus.html#22df9d466522, accessed on 27-04-2018.

Yunus, M., Moingeon, B., & Lehmann-Ortega, L. (2010). *Building Social Business Models: lessons from the Grameen experience.* Paris: HEC.

Zhou, L., Zhang, P., & Zimmermann, H.-D. (2013). Social commerce research: An integrated view. *Electronic Commerce Research and Applications*, 12(2): 61-68. doi: 10.1016/j.elerap.2013.02.003

Zhu, M., Sari, A., & Miyoung Lee, M. (2018). A systematic review of research methods and topics of the empirical MOOC literature (2014–2016). *The Internet and Higher Education*, 37, Pg. 31-39. doi: 10.1016/j.iheduc.2018.01.002

Appendix A. Innovative learning activity

Title
Collaborative virtual libraries

Learning Objectives
- Be aware of the operation of virtual currencies.
- Participate in a social commerce initiative and check how to generate value.
- Promote sustainable development through the sharing of resources.
- Helping students to prepare better study materials.

Description
The activity consists of the development of a learning tool that allows the student to create their own virtual libraries with their own and shared material. In each virtual library, each student can share their class notes or other learning material of their own authorship such as summaries, schema, diagrams, drawings, etc.

Access to the virtual library for both consultation and administration can be achieved through a mobile platform or a desktop computer. The teaching team will have access to all materials and will select the best ones for publication.

An account will be created on social networks so that students and teachers can share comments and experiences about the management of the platform and the materials.

The virtual library is able to perform searches on materials, track visits to each material, save download statistics and save the valuation.

The cost of materials will be fixed by each student owner. From time to time, the system will reward the materials with the highest number of downloads and positive comments with an amount in virtual currencies. To carry out the transactions, a wallet of virtual currencies will be created for each student through which the transactions will be carried out.

For this initiative, a new virtual currency will be created with which the student can become familiar. Libraries and other free distribution tools will be used for the creation of proprietary virtual currencies, such as Omni Layer (http://www.omnilayer.org/) or Feather Coin (https://www.feathercoin.com/).

The evaluation method is carried out by means of the following activities: identification of the problem (35%), creation of the virtual library (35%) and presentation of the final report (30%). The identification of the problem consists of the specification of the functional and non-functional requirements necessary to implement the virtual library. With respect to the virtual library, the quality, validity and number of downloads of the presented contents are evaluated. Last is the report presented by the student, in accordance with the learning objectives.

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-Social economy is rapidly progressing both in human and economic domains.
-Collaborative economy is a type of behaviour that contributes to sustainable living.
-Virtual currencies play an important role in social commerce and sustainability.
-New digital skills need to be added to education curriculums to foster sustainability.